# TRMM/Terra CRS Results and Status

CERES Science Team Meeting
Norfolk, Virginia  May 6, 2002

**Surface and Atmosphere Radiation Budget (SARB) group:**
**T. P. Charlock** (NASA LaRC)
**Fred G. Rose** (AS&M)
**David A. Rutan** (AS&M) – validation and "CAVE" URL
**Zhonghai Jin** (AS&M) - coupled radiative transfer
**Lisa H. Coleman** (SAIC) - Data Management Team
**Thomas E. Caldwell** (SAIC) - Data Management Team

**Seiji Kato** (H.U.) – second part of this presentation with Rose

Access to CAVE on line surface and CERES validation,
point and click Fu-Liou and COART calculations:
www-cave.larc.nasa.gov/cave/  or goggle "CERES CAVE"

Wenying Su

- Foam albedo at COVE with Ken Rutledge
- Ultra Long Duration Balloon (ULDB) mishap
- Icebreaker proposal

Bill Smith, Jr.

- CLAMS manuscripts due this summer for JAS issue

TRMM CRS Edition 2B released last fall
TRMM CRS Edition 2C corrected our reporting of SSF file
Both have two errors:

- Organic carbon aerosols neglected (~10% forcing)
- Cloudy “cosSZA” as 0.5 rather than 0.6, boosting albedo

Land bug Terra Beta run – but test over COVE will be shown

Qiang Fu, Dave Kratz, and Fred Rose – continuum update in progress

Planned changes to SARB in recompetition

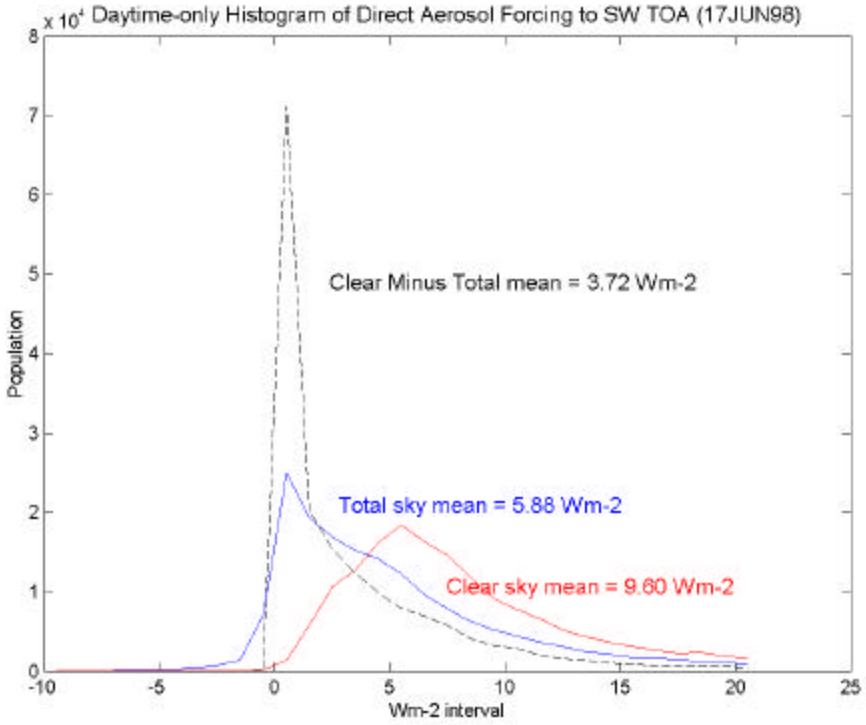
- All-sky direct aerosol forcing (CRS)
- Spectral output at surface (CRS)
- More vertical levels & Surface Albedo Forcing in SYN?

Aerosol direct forcing to SW TOA at cosSZA=0.33.

External mixture of continental AOT=0.25
and soot AOT=0.05.
Aerosol scale height 2km.

One day of processing:

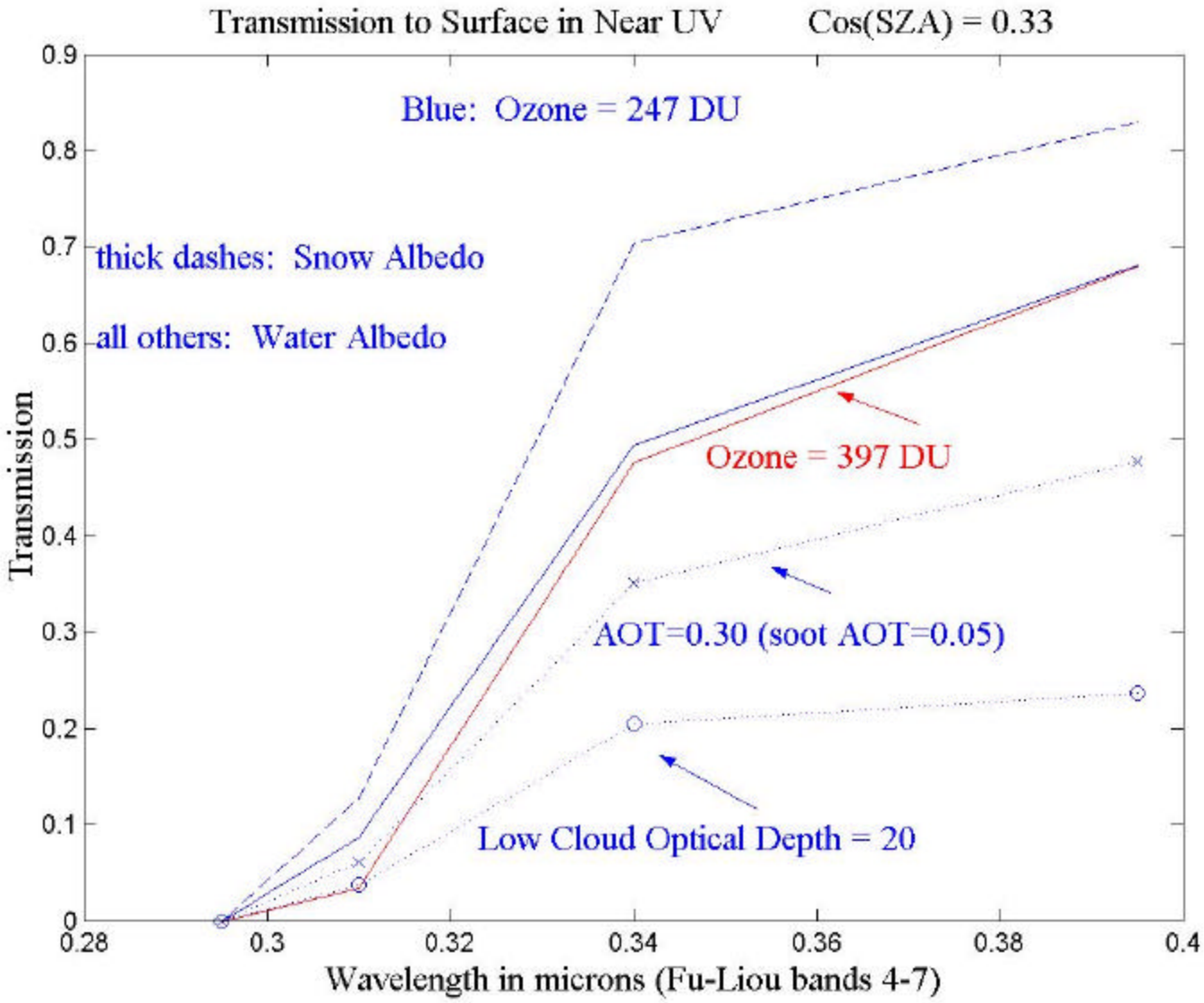
| Cloud top (km) | t | Aerosol forcing SW TOA (Wm-2) | Surface type |
|---|---|---|---|
| clear | 0 | 16 | water |
| 1 | 20 | -21 | water |
| 5 | 20 | -2 | water |
| clear | 0 | -47 | snow |
| 1 | 20 | -37 | snow |
| 5 | 20 | -20 | snow |




We already produce cloud forcing and
clear-sky direct aerosol forcing;
here add all-sky forcing.

May need surface albedo forcing, too.

Future CERES: SPECTRAL output at surface (bio-medical applications)




UV MFRSR already deployed at COVE for validation

TRMM CRS Edition 2b  Comparison with ARM SGP E13

| | Observed mean | N | Obs. - SARB |
|---|---|---|---|
| ALL SKY | Wm-2 | | Wm-2 |
| LW Down Surface | 349 | 455 | -3 |
| LW Up Surface | 416 | 430 | -3 |
| SW Down Surface | 428 | 260 | -21 |
| SW Up Surface | 87 | 260 | 11 |
| LW Up TOA | 247 | 457 | 0 |
| SW Up TOA | 225 | 260 | 2 |
| CLEAR SKY sat. + sfc. | | | |
| SW Down Surface | 324 | 17 | -14 |
| SW Up TOA | 109 | 17 | 1 |
| OVERCAST sat. + sfc | | | |
| SW Down Surface | 156 | 30 | -32 |
| SW Up TOA | 461 | 30 | 3 |

Excuses for errors in SW Down at Surface:

Input AOT is small (60% of Cimel observed)

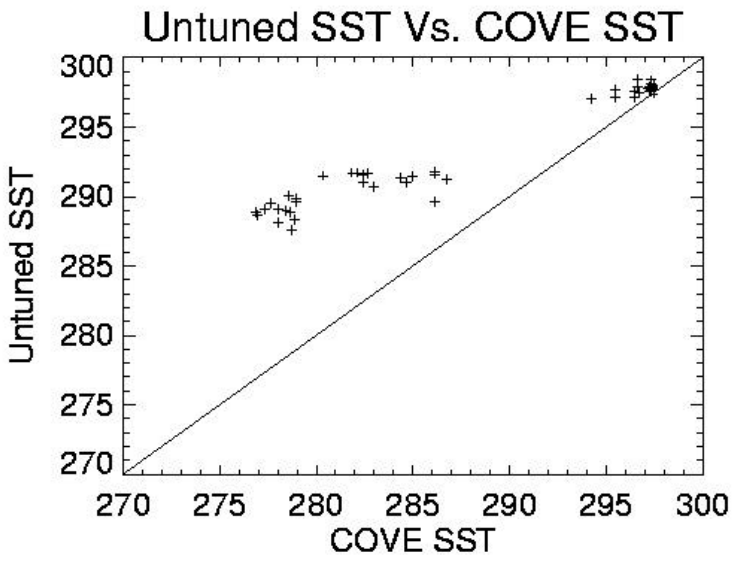
Surface albedo for cloudy sky is not spatially representative

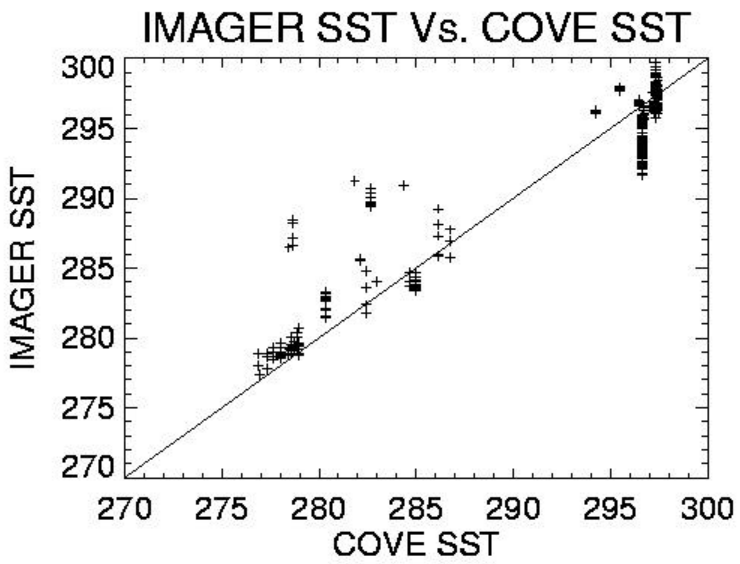
# Terra Beta CRS run for Jan-Apr-Jul 2001

Mistake in aerosol interpolation zaps land footprints

The NOAA/ECMWF SST
that we picked for SARB

The Cloud WG SST
that we ignored




“COVE SST” = in situ measurement

But gliches should have minimal effect on SW over COVE, where

Surface albedo is known

MODIS aerosol retrievals should be okay

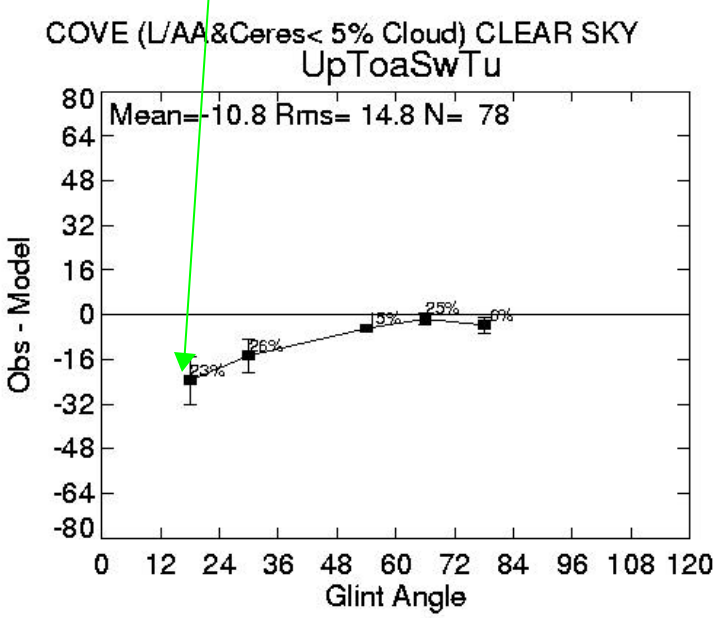
# Beware of sunglint: Tuned SARB results in clear skies (Terra Beta at COVE)

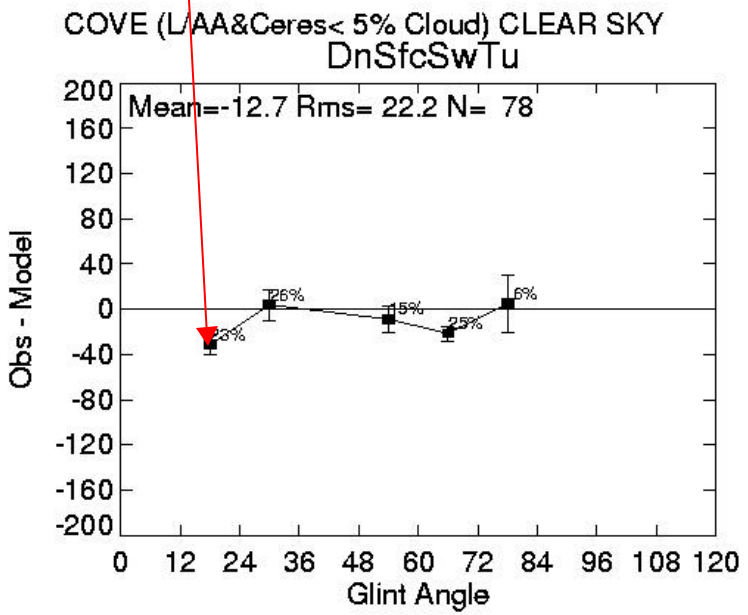
"Glint Angle" = difference of CERES viewing angle
and specular reflection from mirror sea

For 23% of sample

Tuned insolation exceeds observations by ~30 Wm-2
(as if tuned AOT is too low)

Tuned reflection to TOA is much greater than CERES
(as if tuned AOT is too high)



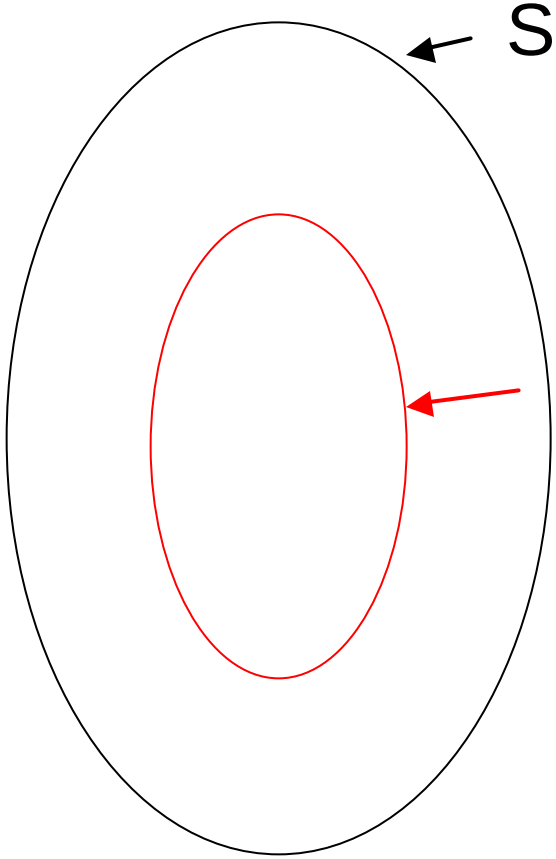
CERES Terra Beta CRS SW SARB over COVE (Jan, Apr, Jul 2001)

PAPS greatly enhanced coverage during CLAMS (July 2001).

Tuned in regular font.
*Untuned in parentheses using italic font.*

| | Observed mean | N | Bias Obs-Sarb | RMS |
|---|---|---|---|---|
| ALL SKY | Wm-2 | | Wm-2 | Wm-2 |
| SW Down Sfc. | 701 | 633 | -8 *(-8)* | 90 *(84)* |
| SW Up at TOA | 209 | 633 | -3 *( 7)* | 15 *(32)* |
| OVERCAST Sat. + Sfc. | | | | |
| SW Down Sfc. | 281 | 109 | -28 *( 17)* | 119 *(104)* |
| SW Up at TOA | 533 | 109 | 4 *(-40)* | 22 *( 52)* |
| CLEAR Sat. + Sfc. | | | | |
| SW Down Sfc. | 816 | 78 | -13 *( 7)* | 22 *(29)* |
| SW Up at TOA | 73 | 78 | -11 *(-21)* | 15 *(27)* |

Why such odd results for overcast?
(Wish we had Su's ULDB to answer)

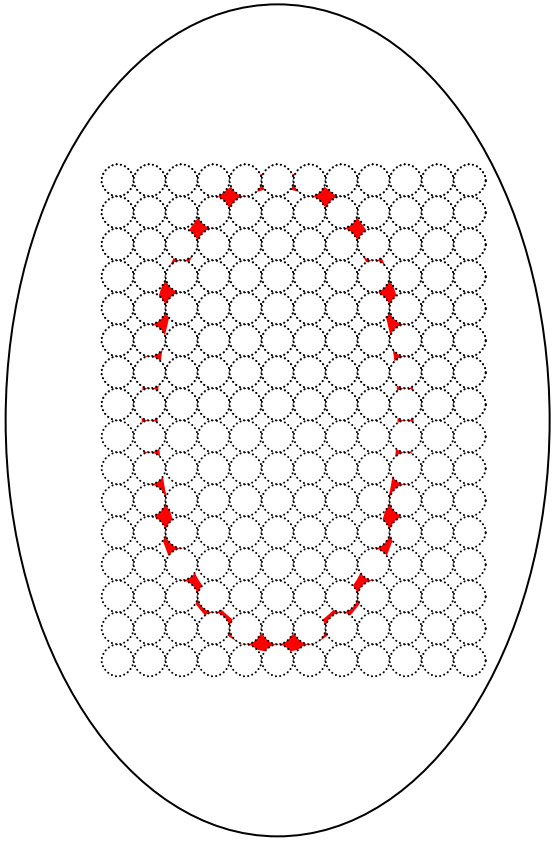


Suppose this is the real footprint,

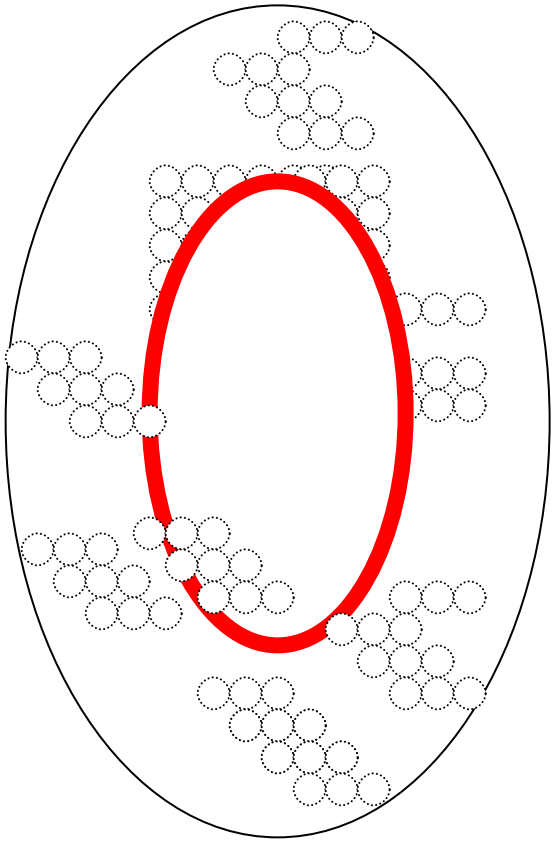
but then we use a Point Spread Function (PSF) that's too small.

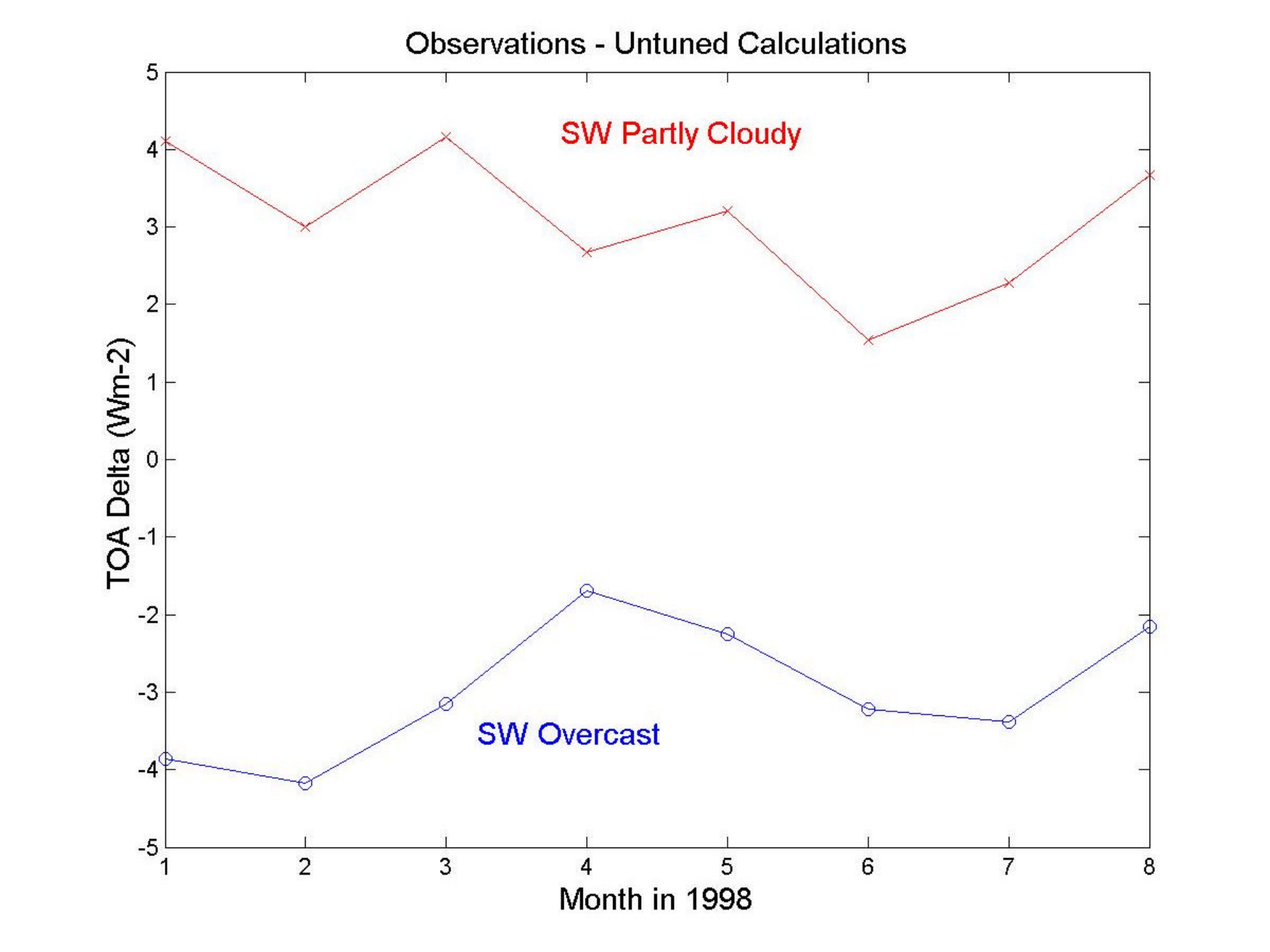
What happens?

By assuming a PSF that's too small (the red oval), we would lable the fooprint as overcast when it's really partly cloudy.

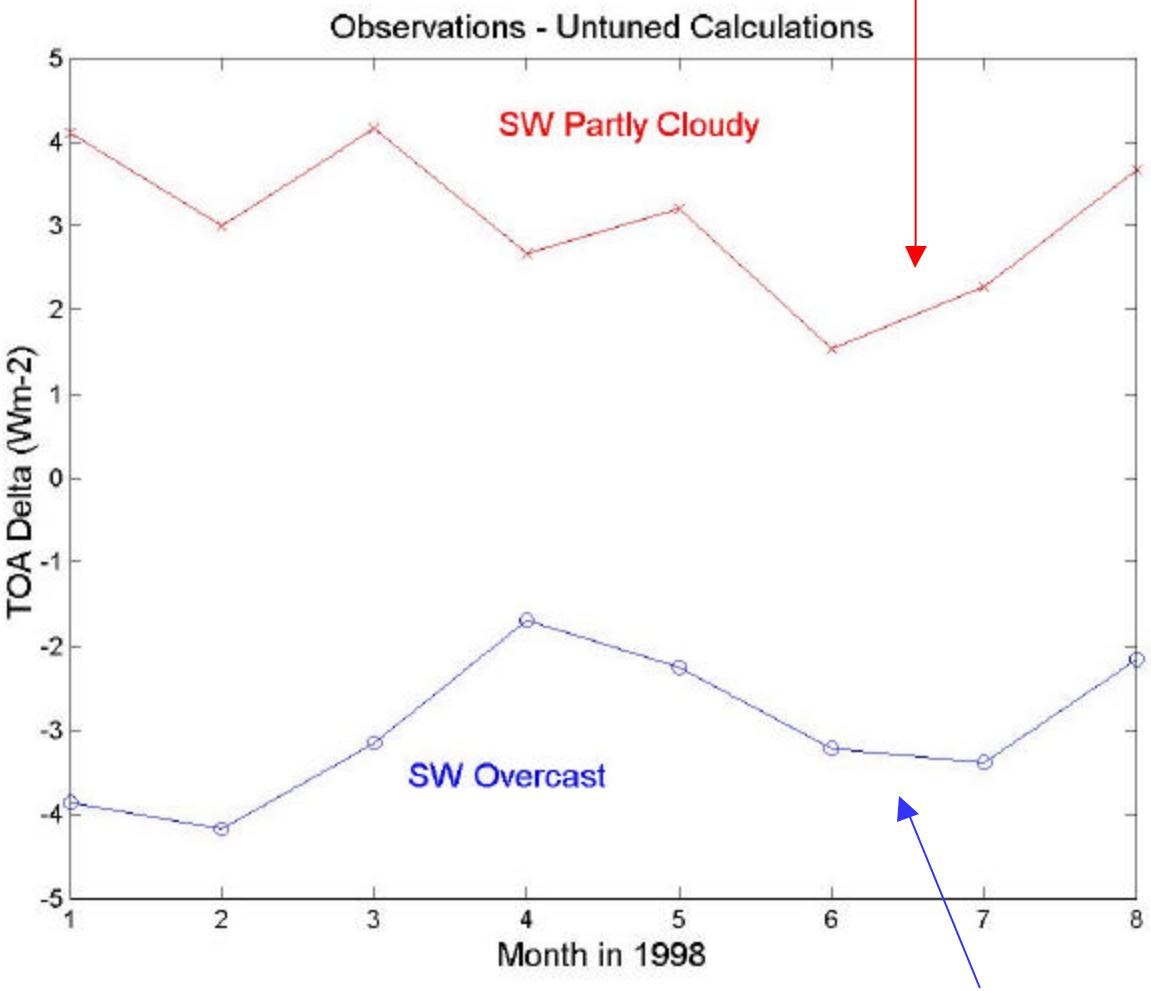


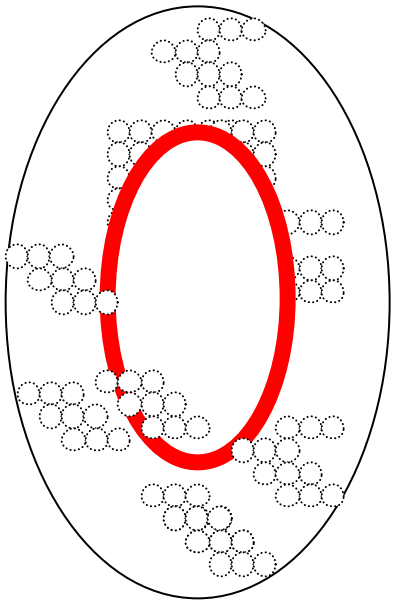
And because the clouds are random, we would greatly underestimate cloud fraction in some partly cloud cases.

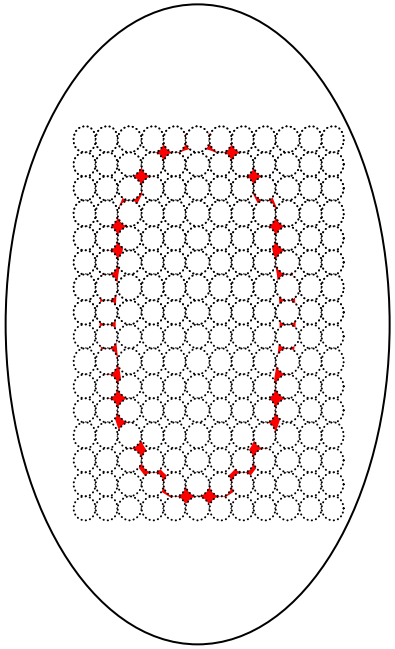



Observations - Untuned Calculations
SW Partly Cloudy
SW Overcast
TOA Delta (Wm-2)
Month in 1998
5
4
3
2
1
0
-1
-2
-3
-4
-5
1
2
3
4
5
6
7
8

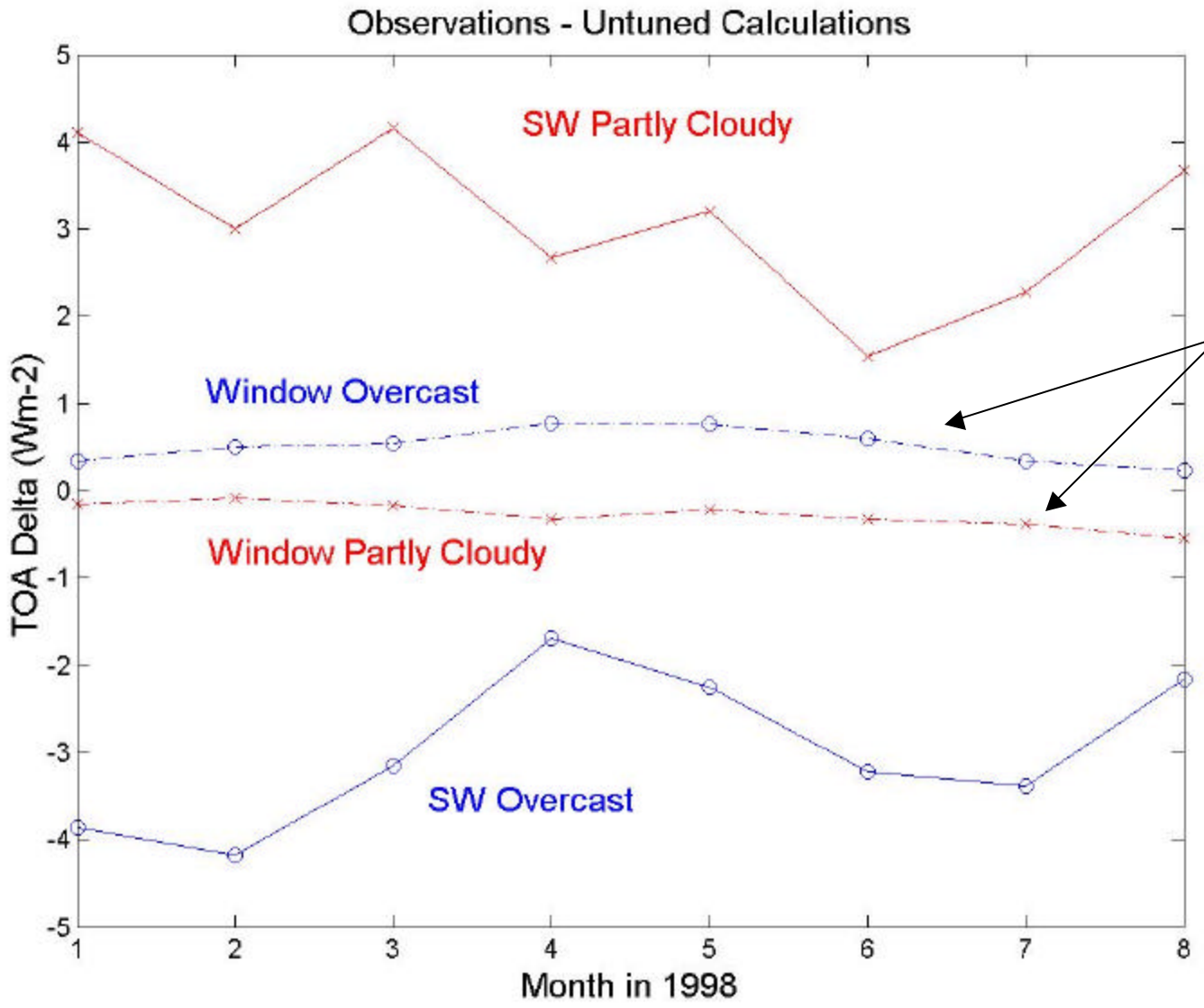
Computed cloud forcing
is too small





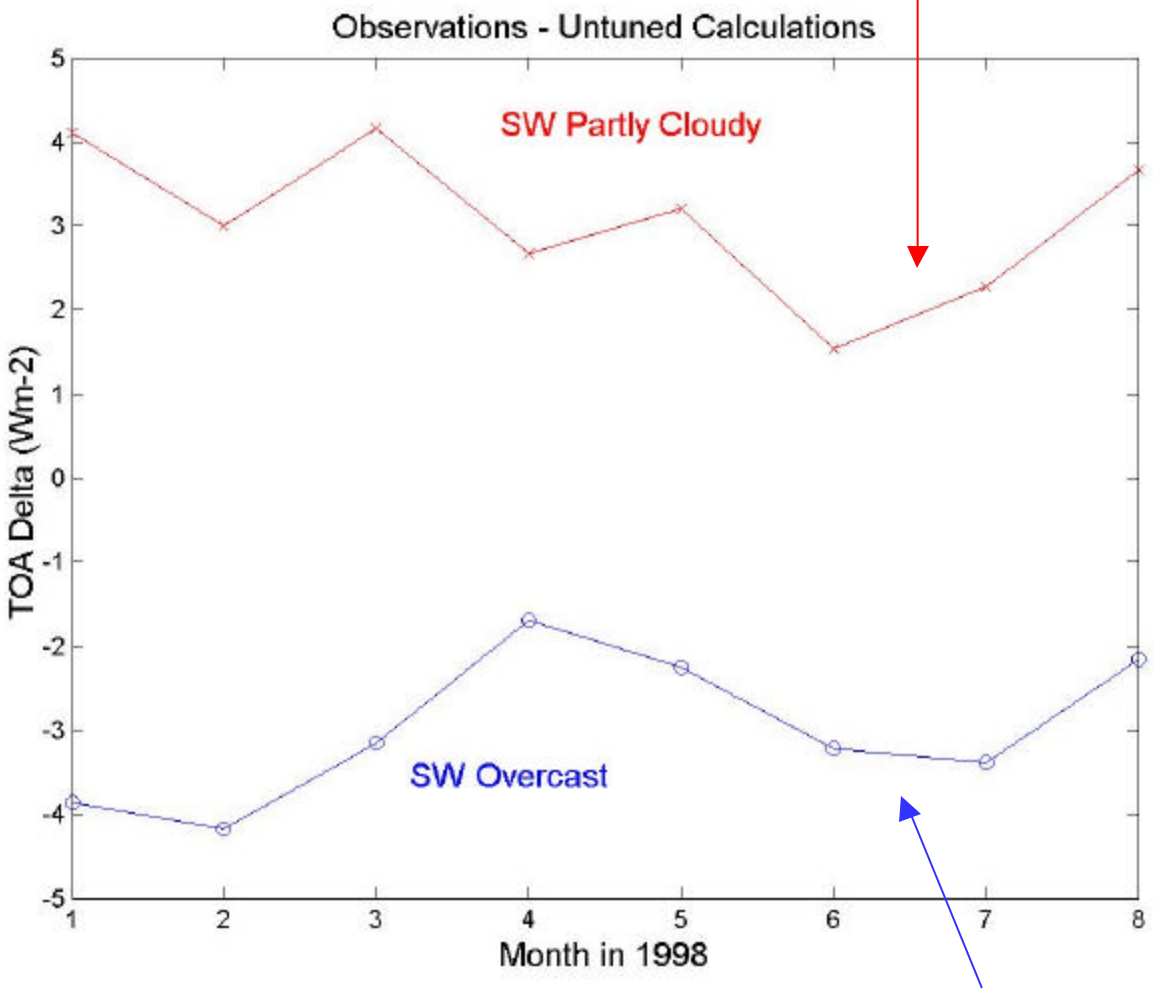
Computed cloud forcing
is too large




Cloud forcing In SW and LW have opposite signs, so window signal here may be consistent.

Signal seen for broadband LW radiance, but not for OLR (flux)

Computed cloud forcing
is too small




What else can do this?

Possibilities include:

3-D effects in ADM
but not in 2 stream

"Gamma distribution"
effect [i.e., need pdf
of tau, not just ln(tau)]

Computed cloud forcing
is too large